

Appendix A-2
National Aeronautics and Space Administration (NASA)

NASA-1	DAT	Design and Analysis Tools
NASA-2	AIP	Aircraft Ice Protection
NASA-3	E&T	Education and Training
NASA-4	AWIN	Aviation Weather Information
NASA-4A	TAMDAR	Tropospheric Airborne Meteorological Detection and Reporting System
NASA-4B	AWARE	Aviation Weather Awareness and Reporting Enhancements
NASA-4C	WINN	Weather Information Network
NASA-4D	EWxR	Enhanced Weather Radar
NASA-4E	AHAS	Airborne Hazard Awareness System
NASA-4F	ASAP	Advanced Satellite Aviation Products
NASA-4G	E-PIREP	General Aviation Oriented Electronic Pilot Report
NASA-5	GIFTS	Geostationary Imaging Fourier Transform Spectrometer
NASA-6	SVS	Synthetic Vision System
NASA-7	TPAWS	Turbulence Prediction and Warning System
NASA-8	WINCOMM	Weather Information Communications

Design & Analysis Tools (DAT)

PROGRAM/PROJECT: Aircraft Icing Project [<http://icebox-esn.grc.nasa.gov>]

LEAD AGENCY/COLLABORATING AGENCIES: National Aeronautics and Space Administration (NASA), Federal Aviation Administration (FAA)

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SERVICE AREA(S)/INITIATIVE(S)

- *National Aviation Weather Initiatives:*
5: 13

FUNDING

- *Programmed/Planned (\$'s/FY):* \$2050K/FY 05 /FY 06 /FY07

TYPE OF PROGRAM/APPLICATION

R&D/Prototype Demonstration

SCOPE OF PROGRAM/PROJECT

- *What's being developed, procured, etc.:* advanced icing simulation software, new experimental methods, and new experimental databases that will enable accurate evaluation of the performance of aircraft and aircraft sub-systems under icing conditions.
- *How will operations be changed/improved:* the tools developed from this element will improve the design, testing, construction, and certification and qualification of aircraft and aircraft sub-systems.

PROGRAM/PROJECT MANAGEMENT

- *Basic guidance document for this program:* Aircraft Icing Project Plan.
- *Program/Project verification process:* National Research Council reviews, peer reviews, and NASA Aircraft Icing Forums.
- *Method used for end product validation:* Technical peer reviews and experimental testing.
- *Operational training for the user:* Specific workshops when new tools are released and help from the Icing Research Branch as needed.

SCHEDULE/IMPLEMENTATION

- *Next major program milestone:* Release of SmaggICE version 1.8
- *Program becomes operational:* The Design & Analysis Tools Element will develop enabling technologies to be implemented by industry, government agencies and academia.
- *Plans for further improvements:* The NASA Aviation Safety and Security Program is in the process of planning follow on activities. Potential follow on research areas related to the Design & Analysis Tools Element are incorporation of complex user-supplied algorithms into a single icing simulation product utilizing modular, component-based design concepts; complete scaling effects study of ice accretion on aircraft aerodynamics; continued development of experimental methods and databases for super-cooled large droplets (SLD); extend ice shape scaling methods to SLD conditions; understand the effect of ice on aircraft control surfaces and the resulting effect on aircraft dynamics.

Aircraft Ice Protection (AIP)

PROGRAM/PROJECT: Aircraft Icing Project [<http://icebox-esn.grc.nasa.gov>]

LEAD AGENCY/COLLABORATING AGENCIES: National Aeronautics and Space Administration (NASA), Federal Aviation Administration (FAA), National Oceanic and Atmospheric Administration (NOAA), and the Department of Defense (DoD)

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SERVICE AREA (S)/INITIATIVE (S)

- *National Aviation Weather Initiatives:*
5: 11

FUNDING

- *Programmed/Planned (\$'s/FY):* \$190K/FY 05 \$K/FY 06 \$K/FY07

TYPE OF PROGRAM/APPLICATION

R&D/Prototype Demonstration

SCOPE OF PROGRAM/PROJECT

- *What's being developed, procured, etc.:* (1) remote sensing technologies to measure icing conditions; (2) systems to monitor and assess aircraft performance; and (3) instrumentation and measurement techniques to characterize atmospheric icing conditions.
- *How will operations be changed/improved:* developments will improve safety, assist in avoidance of icing conditions, and promote improved aircraft certification guidelines.

PROGRAM/PROJECT MANAGEMENT

- *Basic guidance document for this program:* Aircraft Icing Project Plan.
- *Program/Project verification process:* National Research Council reviews, peer reviews, and NASA Aircraft Icing Forums.
- *Method used for end product validation:* Technical peer reviews and experimental testing.
- *Operational training for the user:* None is expected.

SCHEDULE/IMPLEMENTATION

- *Next major program milestone:* Remote sensing ground-based prototype tests
- *Program becomes operational:* The Aircraft Ice Protection Element will develop enabling technologies to be implemented by industry, government agencies and academia.
- *Plans for further improvements:* The NASA Aviation Safety and Security Program is in the process of planning follow on activities. Potential follow on research areas related to the Aircraft Ice Protection Element are ground-based remote sensing field test, flight datalink for icing information, super-cooled large droplet instrumentation technologies.

Education & Training (E&T)

PROGRAM/PROJECT: Aircraft Icing Project [<http://icebox-esn.grc.nasa.gov>]

LEAD AGENCY/COLLABORATING AGENCIES: National Aeronautics and Space Administration (NASA), Federal Aviation Administration (FAA)

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SERVICE AREA(S)/INITIATIVE(S)

- *National Aviation Weather Initiatives:*
5: 5, 12

FUNDING

- *Programmed/Planned (Net \$'s/FY):* **\$300K/FY05** /FY06 /FY07

TYPE OF PROGRAM/APPLICATION

R&D/Prototype Demonstration

SCOPE OF PROGRAM/PROJECT

- *What's being developed, procured, etc.:* in-flight icing related training materials such as videos, computer based training modules, lecture series, and web-based materials. The Education & Training Element is focused on developing materials that support knowledge about in-flight icing, the basic concepts of icing weather, icing operations, and the impact of ice on the aircraft.
- *How will operations be changed/improved:* will improve knowledge about in-flight icing and will contribute to safe operations in and avoidance of icing conditions.

PROGRAM/PROJECT MANAGEMENT

- *Basic guidance document for this program:* Aircraft Icing Project Plan
- *Program/Project verification process:* National Research Council reviews, peer reviews, and NASA Aircraft Icing Forums.
- *Method used for product validation:* Reviews by pilot organizations, safety foundations, airline operators, and operational readiness reviews
- *Operational training for the user:* The products from this element are specifically directed to be used as educational and training materials via text materials, classroom instruction, distance learning, and self-paced instruction.

SCHEDULE/IMPLEMENTATION

- *Next major program milestone:* Icing for Turbine Aircraft Pilots training materials
- *Program becomes operational:* The products are operational when released.
- *Plans for further product improvements:* The NASA Aviation Safety and Security Program is in the process of planning follow on activities. Potential follow on research areas related to the Education & Training Element are developing realistic icing training environments concepts, integration of icing training into other aviation weather hazards, and more use of web-based dissemination methods.

Aviation Weather Information (AWIN)

PROGRAM/PROJECT NAME: Aviation Safety and Security Program/Weather Accident Prevention Sub-Project
[<http://wxap.grc.nasa.gov/awin>]

LEAD AGENCY/COLLABORATING AGENCIES: National Aeronautics and Space Administration (NASA), Federal Aviation Administration (FAA), National Oceanic and Atmospheric Administration (NOAA)

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SERVICE AREA/INITIATIVE

- **National Aviation Weather Initiatives:**
1: 6 2: 3 3: 1, 4 5: 1, 3 6: 3 7: 2, 4 8: 1, 4

FUNDING

- **Programmed/Planned (Net \$'s/FY):** \$3.625M/FY05 /FY06 /FY07

TYPE OF PROGRAM/APPLICATION

R&D/Product Development

SCOPE OF PROGRAM/PROJECT

- **What's being developed, procured, etc.:** Guidelines for the display of weather information in the cockpit; enhanced cockpit display products incorporating in-situ and remotely sensed data, enhanced presentations, and decision aids. Research is addressing both transport and GA operations.
- **How will operations be changed/Improved:** Improves weather situation awareness of pilots in flight, aids decision making related to weather, and assists in the reduction of aircraft accidents attributable to weather. Operators may see added benefit of fuel savings through more efficient strategic avoidance of hazardous weather.

PROGRAM/PROJECT MANAGEMENT

- **Basic guidance document for this Program/Project:** AvSP/WxAP/AWIN Level III Plan.
- **Program/project verification process:** Weather Accident Prevention Project Reviews, NRC Review, Industry Review.
- **Method used for end product validation:** Evaluate technologies through system or subsystem models or prototypes in a relevant environment.
- **Operational training for the user:** AWIN will identify training needs and guidelines to support use of weather information technologies.

SCHEDULE/IMPLEMENTATION

- **Next major program milestone FY 2005 is the final year of WxAP.** AWIN technologies will be evaluated along with turbulence prediction and warning technologies in B-747 simulator at NASA Ames.
- **Program becomes operational:** AWIN develops enabling technologies that need to be implemented by industry or other government agencies. Commercial AWIN systems became available during 2002 and 2003.
- **Plans for further improvement:** With the fielding of first-generation AWIN systems, NASA is focusing on development of next-generation technologies to improve use of data-link weather information with other more conventional cockpit weather information sources, to develop means for trending of data, and to aid weather-related decision-making by flight crews.

Tropospheric Airborne Meteorological Data Reporting (TAMDAR) System

PROGRAM/PROJECT: Aviation Safety and Security Program/Weather Accident Prevention Sub-Project
[http://awin.larc.nasa.gov/tamdar_abs1.htm]

LEAD AGENCY/COLLABORATING AGENCIES: National Aeronautics and Space Administration (NASA), Federal Aviation Administration (FAA), NOAA Forecast Systems Lab (FSL), NOAA National Centers for Environmental Prediction (NCEP), and NOAA National Weather Service (NWS).

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SERVICE AREA(S)/INITIATIVE (S)

- *National Aviation Weather Initiatives:*
3: 2, 5, 6 5: 4, 6, 9 7:1

FUNDING

- *Programmed/Planned (\$'s/FY):* **800K/FY05** **0/FY06** **0 /FY07**

TYPE OF PROGRAM/APPLICATION:

R&D/Product Development

SCOPE OF PROGRAM/PROJECT

- *What's being developed, procured, etc:* A sensor package for aircraft flying below 25,000 feet to measure temperature, pressure altitude, relative humidity, wind speed and direction, turbulence, and ice accretion.
- *How will operations be changed/improved:* Data will be automatically transmitted to the ground for use in weather analyses and forecasts.

PROGRAM/PROJECT MANAGEMENT

- *Basic guidance document for this program:* NASA AvSSPP/WxAP/AWIN Level III Plan; NASA/FAA/NOAA Operational Concepts for Applications of Aircraft Derived Meteorological Information.
- *Program/Project verification process:* Weather Accident Prevention Project Reviews, NRC Review, Industry Review, NASA-FAA-NOAA Tri-Agency Coordination Team.
- *Method used for product validation:* Utilize ground test facilities and instrumented aircraft to conduct ground and flight tests for sensor verification.
- *Operational training for the user:* TBD

SCHEDULE/IMPLEMENTATION

- *Next major program milestone:* 2005 – In-Service Evaluation to test end-to-end system with regional airline in Great Lakes region; ingest data into RUC forecast model; use data to generate local forecasts.
- *Program becomes operational:* 2005 - AirDat to equip other regional airlines and package carriers.
- *Plans for further improvements:* Human Factors research for cockpit display of TAMDAR data. New aviation weather products from TAMDAR data. Aircraft specific conversion of TAMDAR icing and turbulence data.

Aviation Weather Awareness and Reporting Enhancements (AWARE)

PROGRAM/PROJECT: Aviation Safety Program/Weather Accident Prevention Project

LEAD AGENCY/COLLABORATING AGENCIES: National Aeronautics and Space Administration (NASA), Federal Aviation Administration (FAA), National Oceanic and Atmospheric Administration (NOAA), and a Cooperative Research Agreement (CRA) with Rockwell.

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SERVICE AREA (S)/INITIATIVE (S)

- *National Aviation Weather Initiatives:*
N/A

FUNDING

- *Programmed/Planned (\$'s/FY):* FY04 FY05

TYPE OF PROGRAM/APPLICATION

R&D

SCOPE OF PROGRAM/PROJECT

- *What's being developed, procured, etc.:* technologies and prototype to enable display and briefing of flight plan relevant graphical and text-based weather information, and decision support tools to advise pilot of probability of mission success based on pilot preferences, risk tolerance, and aircraft equipage (advisory only).
- *How will operations be changed/improved:* improvements in pre-flight weather briefings, particularly for General Aviation pilots, consisting of flight plan relevant information and decision support aids, will lead to improved pilot situational awareness.

PROGRAM/PROJECT MANAGEMENT

- *Basic guidance document for this program:* WxAP Project Plan.
- *Program/Project verification process:* NASA sponsored annual Weather Accident Prevention reviews, Aviation Safety Program Executive Council reviews, and reviews/audits at the project/element level.
- *Method used for end product validation:* Combination of (a) system-level modeling and simulations, (b) laboratory-based experiments and (c) flight experiments via appropriate industry and/or NASA research aircraft. Many of these validation efforts are performed under cost-shared cooperative research agreements with industry.
- *Operational training for the user:* Training guidance for the use of new graphical weather pre-flight briefings will be developed in conjunction with the AvSP System Wide Accident Prevention (SWAP) project.

SCHEDULE/IMPLEMENTATION

- *Next major program milestone:* AWARE was completed. Technologies to be integrated into the Airborne Hazard Awareness System (AHAS).
- *Program becomes operational:* N/A
- *Plans for further improvements:* N/A

Weather Information Network (WINN)

PROGRAM/PROJECT: Aviation Safety Program/Weather Accident Prevention Project

LEAD AGENCY/COLLABORATING AGENCIES: National Aeronautics and Space Administration (NASA) and Honeywell under a Cooperative Research Agreement (CRA).

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SERVICE AREA(S)/INITIATIVE(S)

National Aviation Weather Initiatives:

N/A

FUNDING

- *Programmed/Planned (\$'s/FY):* FY04 FY05

TYPE OF PROGRAM/APPLICATION:

R&D

SCOPE OF PROGRAM/PROJECT

- *What's being developed, procured, etc.:* a cockpit display and communications capability to deliver near real-time ground-based graphical weather products and other beneficial information to the cockpit and to the Airline Operation Centers.
- *How operations will be changed/improved:* The commercial airline flight crew will have on-demand access to aviation weather information and updates, and automatic access to hazardous weather alerts as they are generated.

PROGRAM/PROJECT MANAGEMENT

- *Basic guidance document for this program:* Honeywell/NASA CRA, contracts with team participants, WxAP Project Plan.
- *Program/Project verification process:* Internal design reviews, customer formal and informal, simulator and revenue aircraft, evaluations and associated reports, quarterly reviews with NASA.
- *Method used for end product validation:* Demonstration/evaluation during in-service evaluations (ISE) on revenue airline flights and flight simulators, ISE on NASA B-757 flight-test aircraft.
- *Operational training for the user:* Hands-on classroom, operator's manual, ground-based network version for training, jump seat trained instructors.

SCHEDULE/IMPLEMENTATION

- *Next major program milestone:* WINN CRA completed in November 2002. Capability to be included in Honeywell's Epic line of avionics.
- *When program will become operational:* N/A
- *Plans for further improvements:* N/A

Enhanced Weather Radar (EWxR)

PROGRAM/PROJECT: Aviation Safety Program/Weather Accident Prevention Project

LEAD AGENCY/COLLABORATING AGENCIES: National Aeronautics and Space Administration (NASA), Federal Aviation Administration (FAA), National Oceanic and Atmospheric Administration (NOAA), Department of Defense (DoD)

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LEAD AGENCY POINT OF CONTACT: Paul Stough, LaRC, 757-864-3860, h.p.stough@larc.nasa.gov

SERVICE AREA (S)/INITIATIVE (S)

- *National Aviation Weather Initiatives:*
N/A

FUNDING

- *Programmed/Planned (\$'s/FY):* FY04 FY05

TYPE OF PROGRAM/APPLICATION

R&D

SCOPE OF PROGRAM/PROJECT

- *What's being developed, procured, etc.:* technologies and prototype to enable display of combined up-linked and on-board sensed graphical weather radar information in transport cockpits. .
- *How will operations be changed/improved:* combined data from diverse weather sources will provide a complete weather picture including information sensed in the near-vicinity of the aircraft, leading to improved pilot situational awareness and allowing collaborative decision making between pilots, ATC, and AOC's.

PROGRAM/PROJECT MANAGEMENT

- *Basic guidance document for this program:* WxAP Project Plan.
- *Program/Project verification process:* NASA sponsored annual Weather Accident Prevention reviews, Aviation Safety Program Executive Council reviews, and reviews/audits at the project/element level.
- *Method used for end product validation:* Combination of (a) system-level modeling and simulations, (b) laboratory-based experiments and (c) flight experiments via appropriate industry and/or NASA research aircraft. Many of these validation efforts are performed under cost-shared cooperative research agreements with industry partners.
- *Operational training for the user:* Training guidance for the use of new graphical weather information technologies will be developed in conjunction with the AvSP System Wide Accident Prevention (SWAP) project.

SCHEDULE/IMPLEMENTATION

- *Next major program milestone:* EWxR activity completed. Technologies to be integrated into the Airborne Hazard Awareness System (AHAS).
- *Program becomes operational:* N/A
- *Plans for further improvements:* N/A

Airborne Hazard Awareness System (AHAS)

PROGRAM/PROJECT: Aviation Safety and Security Program/Weather Accident Prevention Sub-Project

[http://awin.larc.nasa.gov/ahas_abs1.htm]

LEAD AGENCY/COLLABORATING AGENCIES: National Aeronautics and Space Administration (NASA)

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SERVICE AREA(S)/INITIATIVE (S)

- ***National Aviation Weather Initiatives:***

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FUNDING

- ***Programmed/Planned (\$'s/FY):*** **\$300K /FY05** /FY06 FY/07

TYPE OF PROGRAM/APPLICATION:

R&D/Product Development

SCOPE OF PROGRAM/PROJECT

- ***What's being developed, procured, etc:*** A prototype AWIN system is being developed that provides capabilities to combine weather information from various sources, including on-board sensors and datalinks, and to display graphical weather information to the pilot. AHAS can automatically parse text and weather data, convert it to graphics, evaluate both tactical and strategic hazards in the weather data stream, and provide alerts to pilots. AHAS currently supports primarily WxAP AWIN transport research, but has been used for GA purposes.
- ***How will operations be changed/improved:*** **AHAS technologies should** improve situational awareness of flight crews for better hazard avoidance and en route weather decision-making that may also provide airline fuel cost savings.

PROGRAM/PROJECT MANAGEMENT

- ***Basic guidance document for this program:*** AWIN Level III Plan.
- ***Program/Project verification process:*** Weather Accident Prevention Project Reviews, NRC Review, and Industry Review.
- ***Method used for product validation:*** Simulation and flight experiments.
- ***Operational training for the user:*** Training issues will be identified as a consequence of simulation and flight experiments.

SCHEDULE/IMPLEMENTATION

- ***Next major program milestone:*** AHAS will be evaluated in conjunction with turbulence prediction and warning technologies in a commercial jet transport environment using the NASA Ames B-757 simulator.
- ***Program becomes operational:*** NASA will rely on industry to commercialize AHAS technologies.
- ***Plans for further improvements:*** **WxAP ends in FY 2005.** Evolution of AHAS could potentially include integration of TAMDAR-derived products, terrain/traffic, "three-dimensional" weather displays, and tactical/terminal-areas products.

Advanced Satellite Aviation-weather Products (ASAP)

PROGRAM/PROJECT: Aviation Safety and Security Program/Weather Accident Prevention Sub-Project

LEAD AGENCY/COLLABORATING AGENCIES: National Aeronautics and Space Administration (NASA), Federal Aviation Administration (FAA), and National Weather Service (NWS)

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SERVICE AREA(S)/INITIATIVE (S)

- *National Aviation Weather Initiatives:*

2: 9 3: 6 5: 11 7: 12 8: 7

FUNDING

- *Programmed/Planned (\$'s/FY):* \$1.9M/FY05 /FY06 /FY07

Note: R&D is jointly funded by the Aviation Safety Program and NASA's Earth Science Applications Division.

TYPE OF PROGRAM/APPLICATION

R&D/Product Development

SCOPE OF PROGRAM/PROJECT

- *What's being developed, procured, etc:* Technologies are being developed to enable use of current and next-generation satellite data to improve aviation weather products. Technology will be used in the FAA Aviation Weather Research Program (AWRP) for product development. Feasible products include convection, turbulence, icing, volcanic ash, and winds.
- **How will operations be changed/improved:** Better aviation forecasts and weather hazard information will lead to improved safety and efficiency within the National Airspace System.

PROGRAM/PROJECT MANAGEMENT

- *Basic guidance document for this program:* AWIN Level III Plan.
- *Program/Project verification process:* Weather Accident Prevention Project Reviews, NRC Review, Industry Review, FAA AWRP reviews and Aviation Weather Technology Transfer (AWTT) process.
- *Method used for product validation:* AWTT process.
- *Operational training for the user:* TBD

SCHEDULE/IMPLEMENTATION

- *Next major program milestone:* Working with the FAA AWRP Oceanic Weather Product Development Team, to deliver satellite-based convective initiation fields in FY2005 that are needed to produce a prototype FAA oceanic convective weather product.
- *Program becomes operational:* NASA will rely on FAA and NWS to implement technologies in new weather products.
- *Plans for further improvements:* Initial effort focusing on use of existing satellite data; future work will prepare for use of data from next-generation high-resolution satellite sounders.

General Aviation Oriented Electronic Pilot Report (E-PIREP) Generation and Datalink System

PROGRAM/PROJECT: Aviation Safety Program/Weather Accident Prevention Project
[http://awin.larc.nasa.gov/e-pirep_abs1.htm]

LEAD AGENCY/COLLABORATING AGENCIES: National Aeronautics and Space Administration (NASA), Federal Aviation Administration (FAA), and the National Weather Service (NWS).

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SERVICE AREA(S)/INITIATIVE (S)

- *National Aviation Weather Initiatives:*
N/A See NASA-6A

FUNDING

- *Programmed/Planned (\$'s/FY):* FY04 FY05

TYPE OF PROGRAM/APPLICATION:

R&D/Product Development

SCOPE OF PROGRAM/PROJECT

- *What's being developed, procured, etc:* a system for the automatic reporting (E-PIREP) of weather information from general aviation aircraft via VHF data link (VDML).
- *How will operations be changed/improved:* Such applications include both real-time sharing of data between equipped aircraft, and inclusion of E-PIREP data into weather analysis, modeling, and forecasting processes to create more accurate predictions of hazardous conditions.

PROGRAM/PROJECT MANAGEMENT

- *Basic guidance document for this program:* N/A
- *Program/Project verification process:* N/A
- *Method used for product validation:* N/A
- *Operational training for the user:* N/A

SCHEDULE/IMPLEMENTATION

- *Next major program milestone:* This cooperative research effort with industry partner Honeywell completed Phase I of activity. Honeywell chose not to pursue Phase II.
- *Program becomes operational:* Program activity was superseded by in-house effort called Tropospheric Airborne Meteorological Data Reporting (TAMDAR).
- *Plans for further improvements:* N/A

Geostationary Imaging Fourier Transform Spectrometer (GIFTS)

PROGRAM/PROJECT:

LEAD AGENCY/COLLABORATING AGENCIES: National Aeronautics and Space Administration (NASA), National Oceanic and Atmospheric Administration (NOAA)

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SERVICE AREA (S)/INITIATIVE (S)

- *National Aviation Weather Initiatives:*
3: 6

FUNDING

- *Programmed/Planned (\$'s/FY):* / FY 05 / FY06 /FY07

TYPE OF PROGRAM/APPLICATION

Engineering Development Demonstration - Benefit to HES/GOES-R

SCOPE OF PROGRAM/PROJECT

- *What's being developed, procured, etc.:* new technologies for measuring altitude-resolved winds and temperatures from geostationary orbit. Technologies include a Michelson interferometer, large area detector arrays, high speed analog-to-digital conversion systems, and light weight optics and structures.
- *How will operations be changed/improved:* High- resolution wind and temperature measurements will enhance numerical weather prediction and improve flight safety and efficiency.

PROGRAM/PROJECT MANAGEMENT

- *Basic guidance document for this program:* NA
- *Program/Project verification process:* Normal series of reviews (PDR, MCR, CDR) in accordance with NASA 7120.4A.
- *Method used for end product validation:* Evaluation of Calibration Data.
- *Operational training for the user:* Not applicable.

SCHEDULE/IMPLEMENTATION

- *Next major program milestone:* NA
- *Program becomes operational:* This program is not intended to become operational. It's a demonstration of a new measurement concept for water vapor winds. The first operational system scheduled to be flown on GOES R in the 2010-2012 timeframe.
- *Plans for further improvements:* Technology to be infused into the NOAA Advanced Baseline Sounder Program.

Synthetic Vision System (SVS)

PROGRAM/PROJECT: Aviation Safety Program

LEAD AGENCY/COLLABORATING AGENCIES: National Aeronautics and Space Administration (NASA)

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SERVICE AREA (S)/INITIATIVE (S)

- *National Aviation Weather Initiatives:*
1: 14

FUNDING

- *Programmed/Planned (Net \$'s/FY):* /FY 05 /FY 06 /FY 07

TYPE OF PROGRAM/APPLICATION

R&D/Decision Support

SCOPE OF PROGRAM/PROJECT

- *What's being developed, procured, etc.:* a display of terrain and other airport surface features to provide guidance cues and enhance airport surface awareness. The SVS Project will develop and demonstrate display configurations, display concepts, and enabling technologies.
- *How will operations be changed/improved:* Eliminates low visibility conditions as a causal factor to civil aircraft accidents. In addition, SVS will increase National Airspace System efficiency by allowing operations to more runways and to lower weather minimums.

PROGRAM/PROJECT MANAGEMENT

- *Basic guidance document for this program:* SVS Project Plan, dated November 28, 2001.
- *Program/Project verification process:* The SVS Project participates in annual independent reviews and in reviews by the Aviation Safety Program's Executive Council.
- *Method used for end product validation:* The Office of Mission Assurance will provide support to the SVS Project in the areas of systems safety, reliability, quality assurance and environmental impact. Analyses will be prepared in order to develop a safety information package to provide to industry partners to facilitate or expedite their certification of the technology. Technologies are also validated using simulations and flight tests.
- *Operational training for the user:* Industry will be responsible for setting training standards for their final, certified products.

SCHEDULE/IMPLEMENTATION

- *Next major program milestone:* 1QFY04- Initial air transport flight evaluation using SVS display concepts integrated with runway incursion prevention concepts.
- *Program becomes operational:* The SVS Project develops enabling technologies that must be implemented by industry or other government agencies. The current research and technology project is funded through FY 05. Operations in air transport aircraft probably at least five years away.
- *Plans for further improvements:* Consider advanced display media and other second-generation SVS technologies that will be flyable and navigable.

Turbulence Prediction and Warning Systems (TPAWS)

PROGRAM/PROJECT: Aviation Safety and Security Program/Weather Accident Prevention Sub-Project
[<http://tpaws.larc.nasa.gov>]

LEAD AGENCY: National Aeronautics and Space Administration (NASA)

LEAD AGENCY POINT OF CONTACT: Gus Martzaklis, GRC, 216-433-8966,
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SERVICE AREA (S)/INITIATIVE (S)

- *National Aviation Weather Initiatives:*
7: 7, 9

FUNDING

- *Programmed/Planned (\$'s/FY):* \$2.5M/FY 05 \$0/FY 06 \$0/FY07

TYPE OF PROGRAM/APPLICATION

R&D/Decision Support

SCOPE OF PROGRAM/PROJECT

- *What's being developed, procured, etc.:* Onboard systems technologies development to detect turbulence, provide warning and mitigate its impacts. Testing is underway to identify performance of technologies in the relevant atmospheric environment and test techniques and criteria are being explored for use in the eventual hardware certification process by the FAA. Technologies include Light Detection and Ranging (LIDAR), enhanced onboard radar (RADAR), and Turbulence AutoPIREP System (TAPS).
- *How will operations be changed/improved:* Early detection of flight path turbulence, and awareness of existing near-by turbulence encounters, to reduce the risk of turbulence-induced injury or death by providing timely warning of impending turbulence encounters.

PROGRAM/PROJECT MANAGEMENT

- *Basic guidance document for this program:* Weather Accident Prevention Project Level II Plan.
- *Program/Project verification process:* Annual Weather Accident Prevention Project reviews.
- *Method used for end product validation:* Flight testing in a relevant atmospheric environment and In Service Evaluations with major airline.
- *Operational training for the user:* NASA is addressing certification issues with the FAA. User training will be developed by In-Service-Evaluations and when the technologies are transitioned to full operational use.

SCHEDULE/IMPLEMENTATION

- *Next major program milestone:* In-Service-Evaluation of Enhanced Turbulence Radar <pre-production prototype> with a major airline, and In-Service-Evaluation of TAPS on major airline fleet, both in FY05.
- *Program becomes operational:* TPAWS develops technologies that will be implemented by avionics/airline operations industry or government agencies.
- *Plans for further improvements:* Production units will be manufactured by avionics manufacturers for new/retrofit equipment for airline fleets.

Weather Information Communications (WINCOMM)

PROGRAM/PROJECT: Aviation Safety and Security Program/Weather Accident Prevention Project
[<http://wxap.grc.nasa.gov/wincomm>]

LEAD AGENCY/COLLABORATING AGENCIES: National Aeronautics and Space Administration (NASA)/ Federal Aviation Administration (FAA), National Oceanic and Atmospheric Administration (NOAA), Department of Defense (DoD)

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SERVICE AREA (S)/INITIATIVE (S)

- *National Aviation Weather Initiatives:*
1: 2 2: 2 3: 3 5: 2 6: 2 7: 3 8: 2

FUNDING

- *Programmed/Planned (\$'s/FY):* 1.698M (net)/FY 05

TYPE OF PROGRAM/APPLICATION

R&D/Product Dissemination

SCOPE OF PROGRAM/PROJECT

- *What's being developed, procured, etc.:* optimize air-to-air and air-to-ground data link technologies such as UAT, VDLM2/3, and Mode S to enable the transmission of weather information to the cockpit. WINCOMM will define communication requirements, assess the current communications infrastructure, and apply/develop technologies to satisfy gaps.
- *How will operations be changed/improved:* new communications technologies will provide a capability to up-link weather information to pilots in the cockpit, increase situational awareness, and assist in the reduction of aircraft accidents attributable to weather.

PROGRAM/PROJECT MANAGEMENT

- *Basic guidance document for this program:* WINCOMM Level III Element Plan.
- *Program/Project verification process:* NASA sponsored annual Weather Accident Prevention reviews, Aviation Safety Program Executive Council reviews, and reviews/audits at the project/element level.
- *Method used for end product validation:* Combination of (a) system-level modeling and simulations, (b) laboratory-based experiments and (c) flight experiments via appropriate industry and/or NASA research aircraft. Many of these validation efforts are performed under cost-shared cooperative research agreements with industry partners.
- *Operational training for the user:* Not applicable since datalink technologies are generally not end-user devices requiring training.

SCHEDULE/IMPLEMENTATION

- *Next major program milestone:* 4QFY04 - Initial lab evaluation of next-generation weather datalink technologies. 1QFY05 - Final flight test plan. 3QFY05 - Flight evaluation of developed datalink technologies.
- *Program becomes operational:* WINCOMM develops enabling technologies that need to be implemented by partners within industry or other government agencies.
- *Plans for further improvements:* Proposed post-FY05 work under consideration builds upon successes by leveraging broad user-base commercial technologies for required increased capacity and lower cost for weather dissemination for the aviation community to further increase safety benefits and encourage voluntary equipage.